CARPENTER'S FORD BRIDGE
(BRIDGE NO. 6147)
Virginia Route #775, over the Middle River
Mt. Meriden vicinity
Augusta County
Virginia

HAER No. VA-99

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Custom House
200 Chestnut Street
Philadelphia, PA 19106

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HISTORIC AMERICAN ENGINEERING RECORD
CARPENTER'S FORD BRIDGE
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LOCATION: Virginia Route 775 over the Middle River, 0.5 miles northwest of the junction of Routes 775 and 608, Mt. Meriden Vicinity, in Augusta County, Virginia. USGS Fort Defiance, VA Quadrangle, Universal Transverse Mercator Coordinates: 17.685420.4234480

DATE OF CONSTRUCTION: 1903-1904

CONTRACTOR: Brackett Bridge Company, Cincinnati, Ohio

PRESENT OWNER: Virginia Department of Transportation

SIGNIFICANCE: Carpenter's Ford Bridge is a representative example a pin-connected steel Pratt through truss, typical of late nineteenth century factory manufactured bridges.

PROJECT INFORMATION: Carpenter's Ford Bridge was recorded in 1994 by the Cultural Resource Group of Louis Berger & Associates, Inc., Richmond, Virginia for the Virginia Department of Transportation (VDOT). The recordation was undertaken pursuant to provisions of a Programmatic Memorandum of Agreement (Draft) among the Federal Highway Administration, VDOT, the Virginia SHPO and the Advisory Council on Historic Preservation concerning management of historic metal truss bridges in Virginia. Project personnel included Richard M. Casella, Architectural Historian, Alison Helms, Historian, and Rob Tucher, Photographer.

DESCRIPTION

Carpenter's Ford Bridge (VDOT Bridge No. 6147) is a single-span, pin-connected steel through truss bridge which carries a single lane of Virginia State Route 775 in a north-south direction over the Middle River, 0.5 miles northwest of the junction of Route 775 and Route 608, in Augusta County, Virginia (Figure 1). Overall, the bridge is 140' long. At the point of the bridge the riverbed is approximately 100' wide, spanned by the truss at a height of approximately 22' above the water. The river flows north at an average depth of about 2'; measured in November. The immediate area around the bridge is open rolling farmland and pasture with scattered farm complexes and residences.

The truss is a Pratt type, with parallel chords, posts in compression and diagonals in tension. All members of the bridge are steel, joined with pinned, riveted or threaded connections. The truss is 19' high, 14' wide and 140' long overall, with eight panels, each 17'-6" wide.

Top chords and inclined end posts are riveted box sections, 12"x8-1/2" overall, built with 1/4" top plate, 8"x2-1/4" side channels with flanges turned out and 12"x4"x1/4" bottom stay plates spaced 3' on center. The south end of the truss rides on two plate-and-roller type bearings; the north end rests on fixed bed-plate bearings. Both bearing types are 12"x19" overall. Bottom chords consist of two loop-welded eye-bars, varying in size between posts. The bottom chords connecting the end post to the hip-verticals and the hip-verticals to the first post are 5/8"x3". The first to second post chords are 7/8"x4"; and the second to third post chords are 1"x4".

The riveted box-section bar-lattice posts are 11" wide by 6" deep overall, made up of two 6"x2" channels with flanges turned out, spaced 7" apart, and connected by 1-5/8"x15" single bar-lattice. Diagonals consists of two loop-welded eye-bars of three sizes: end post to first post diagonals are 3-1/2"x5/8"; first to second post diagonals are 2-1/2"x5/8"; and second post to center post diagonals are 2"x1/2". Adjustable counters, consisting of a single rod with a turnbuckle are located in the third and fourth panels, counted in from each end. Panel three counter is 3/4" in diameter and panel four counter is 1" in diameter. The hip-verticals are a single bar with loop-welded eyes, 2-1/2"x3/4".

Portal struts are built up I-sections, 18"x6-1/4" overall, constructed with a 1/4" plate web and double 3" angle flanges. The web plate is decorated with three pentafoil cutouts. Upper lateral struts are riveted T-sections of double 3" angles and the upper lateral bracing rods are 3/4" in diameter with loop-welded eyes. Other than the portal bracing described, there is no intermediate sway bracing. All pins are 2-3/4" in diameter with the exception of the top chord to post connections which are 2-3/16".

The floor beams are 12"x5" rolled I-beams, hung from the bottom chord pins at each post and at the hip-vertical connection by 1" diameter beam hangers and beam hanger plates. A total of six floor stringers, each 8"x4" rolled I-beams, are spaced approximately 24" on center. Bottom lateral bracing rods are 1", with a loop-welded eye on one end and the other end threaded. Bottom lateral connection to the floor beam is made with angle brackets riveted to the beam, spaced and bored to accept a pin for the eye-end and corner chamfered to accept washer plates and hex nuts to secure the threaded ends and allow adjustment.

The bridge decking consists of 4"x10" pressure-treated wood planks, coated with asphalt and attached to the stringers with carriage bolts and deck clips. The roadway is 11' wide and edged with 4"x5" wood curbing raised 5" off the decking with wood blocks spaced approximately 4' on center. The bridge railings are of double lattice-bar construction, 12"x2" overall, attached to the posts with short sections of angle. The top of the railing is 36" off the deck.

The south end of the bridge rests on a beveled-wing abutment of random ashlar, quarry-faced limestone, approximately 12' high and 16' wide. The abutment is at the water's edge and mortar joints in the lower half of the abutment are crumbling or missing. The north end of the bridge rests on a concrete bevel-wing abutment approximately 14' high with a 16' wide face and 20' wide wings. The concrete appears to have been placed around the original stone abutment which extends beyond the wings on each side approximately 10'.

HISTORICAL INFORMATION

Background

The land surrounding Carpenter's Ford Bridge across the Middle River was contained within patents granted to David Logan in 1740, and George Rankin in 1747. David Logan sold his 192-acre tract on the southeast side of Middle River to Robert Craig on February 16, 1748. Craig was probably the first to establish a farm on the tract, which, after the American Revolution, was named "Bunker Hill Plantation" by the local people. Robert's son John conveyed the farm to James Johnston on April 19, 1793. After this transfer, the farm remained in the Johnston family until 1882, and was managed by the executors of Zecheriah Johnston until 1905 (May 1987:27-29).

Zecheriah Johnston, the property owner of longest tenure, purchased Bunker Hill Plantation from his parents, James and Esther, on February 1, 1823. During the Civil War, he suffered serious personal and financial losses; his son Zecheriah II was killed in action, he lost all of his slaves through emancipation, and his barn was burned in the spring of 1864 just before the battle of Piedmont. Zecheriah's will, probated in March of 1884, directed his executor, David Beard, to sell the farm as soon after his death as he judged wise, but asked that it be rented until sold. He also directed that one acre of the farm be reserved as a family burial plot, and that it should

be kept well fenced by subsequent purchasers of the farm. The farm was sold 21 years later, in 1905, to John Will Carpenter, a wealthy farmer and stockraiser, who had been residing on a farm directly across the river since at least 1884 (Hotchkiss 1885; May 1987:29; Rohrer & Diamond 1899:35; VDHR file 7-1075).

History of Carpenter's Ford Bridge

Carpenter's Ford Bridge, also known as the "Middle River Steel Truss" was built during the winter of 1903-1904, at Carpenter's Ford, near John W. Carpenter's farm. The ford appears to have been established after the Civil War, between 1865 and 1885, when the precursor to State Route 775 was laid out across the Middle River Valley to connect the Staunton-New Hope Road with the Valley Turnpike (Hotchkiss 1865; 1885:17; VDHR file 7-1077).

The surrounding area in the Middle River Valley being a rich center for agriculture, the bridge at Carpenters Ford gave farmers of the area two railroad shipping options; they could transport their produce west to Mount Sidney, a stop on the Valley Division of the Baltimore & Ohio Railroad, or east to Patterson Station on the Shenandoah Valley Railroad (Hotchkiss 1885:77). The bridge was built at a time when the automobile was becoming popular, and when the Virginia Good Roads Movement was achieving the passage of much-needed legislation authorizing counties to levy road taxes in order to generate funding for county road improvements (MacMaster 1987:133-134).

A petition for "a bridge over Middle River at Carpenter's Ford" was filed in the Augusta County Court at Staunton by John W. Carpenter and other citizens on June 22, 1903 (Augusta County Order Book 74:33). The petition was referred to the Road Board of Middle River District, and, on July 30, 1903, the Board presented their report recommending that the bridge be established. After hearing testimony from witnesses John G. Fulton, Supervisor, J.W. Byers, Road Commissioner, two members of the Road Board, and the attorney for the Commonwealth, the court determined that the bridge was a public necessity, and decided in favor of the proposed construction. The bridge was ordered to be built for a sum not exceeding $4,500; one-quarter of the cost was to be provided by the petitioners, and the remainder was to be paid by the county. The construction of the bridge was not to be commenced until the amount to be contributed by the petitioners was paid to the county treasurer. A copy of the court order was certified to the Board of Supervisors for their approval (Augusta County Order Book 74:64).

At a meeting of the Board of Supervisors held August 1, 1903, Supervisor John G. Fulton moved that the bridge petition be granted, and the ensuing vote resulted in the approval of the construction. The Board ordered that the sum of $4,500 be appropriated for the construction, specifying that amount, the petitioners had agreed to contribute $1,300 (a sum which exceeded one-quarter of the total cost by $175). The contribution from the petitioners was deemed

expedient, because of "public necessity for the benefit of the people of the neighborhood in the vicinity of the bridge" (Augusta County Board of Supervisors Order Book 4:241).

The petitioners by their attorney presented the order of the Board of Supervisors to the County Court on August 24, 1903, and the Road Board was directed to proceed without delay to build the bridge in accordance with the report of the Road Board, as soon as the petitioners had paid the county treasurer the $1,300 contribution. When the bridge was complete, the Road Board was to report to the court on the manner and execution of the work (Augusta County Order Book 74:69).

Surviving county records indicate that the substructure of the bridge was commenced during the fall of 1903, and that the superstructure was probably delivered to the site by January of 1904. At a meeting of the Board of Supervisors held December 19, 1904, a warrant for $1,000 was issued to Mr. J.T. Muddiman for the construction of the abutments for the bridge (Augusta County Board of Supervisors Order Book 4:264). On January 25, 1904, two warrants were ordered issued to the Brackett Bridge Company, of Cincinnati, Ohio, for the Carpenter and Miller Bridges; one for $1,825.00 payable at once, and one for $2,825 to be paid June 1, 1904 (Augusta County Board of Supervisors Order Book 4:271). The order does not specify which sum was paid for which bridge. Given that the county approved the construction of a bridge at Carpenter's at a cost not to exceed $4,500, and that at least $1,000 was paid for abutments, it appears that the payment of either sum would allow the bridge to be completed within budget.

March 28, 1904, the Board of Supervisors ordered that a warrant for $64.20 be issued to John M. Eutsler for the balance due him for construction of approaches to the bridge. The same day, J.F. Muddiman was paid $172.80 for the balance due him for construction of abutments. Since final payments for bridge construction projects were not made until after the structure was completed and load-tested, it is very likely that the $1,825 warrant issued by the Board of Supervisors to the Brackett Bridge Company on January 25, 1903 applies to Carpenter's Bridge (Augusta County Board of Supervisors Order Book 4:277).

John Will Carpenter appears to have been the leading local subscriber for construction of the bridge. At the time the petition for the bridge was made, he was a man of considerable wealth, and may have been contemplating purchasing the Bunker Hill Farm, which lay on the southeast side of the river, opposite his own farm. He purchased the farm in 1905, after the bridge was complete, and the bridge facilitated his access to the new property (May 1987:30-31; Hotchkiss 1885:77).

Between 1905 and 1910, Carpenter built a grand, Victorian-style house on the site of the old Bunker Hill plantation in anticipation of his planned marriage to Olga Patterson Mohler of the Grottoes-Mount Meridian community. He contracted with the Eutsler Brothers, of Grottoes in Rockingham County, the most prominent local builders of the time, to build the dwelling. They

designed a two-story, ten-room frame house with a front central turret, a wrap-around porch, an office, a slate hipped-roof, a basement, and an attic (May 1987:30; VDHR file 7-1075).

J.W. Carpenter moved into the house five years after it was built, but the marriage he hoped would take place never occurred, because Olga Mohler chose to marry another rising young farmer and businessman in the community, John Givens Fulton III. Heartbroken with disappointment, Carpenter moved back to his old house across Middle River and turned his energies towards making money and buying land. At his death in 1930, he owned six Middle River farms (May 1987:33-34; VDHR file 7-1075).

Thomas Pratt and the Pratt Truss

Thomas Pratt was born in Boston in 1812, the son of noted Boston architect Caleb Pratt. Thomas was thoroughly educated by his father in the sciences, entered Rensselaer Polytechnic Institute at age 14, became an engineer with the United States Army Engineers at 18, and began a professional engineering career with Boston & Maine Railroad at age 21. At the beginning of his career, which lasted until his death in 1875, Pratt was probably the best educated bridge engineer in America. Pratt worked his entire life in the employ of various New England railroad companies, including the Providence & Worcester, the Hartford & New Haven, and the New York & Boston (American Society of Civil Engineers [ASCE] 1876:332-333; Condit 1960:108).

Pratt is best remembered for a bridge truss that he designed in 1842, that consisted of two parallel chords connected by vertical wood posts in compression and double wrought iron diagonals in tension. The design, while similar in appearance to the truss recently patented by William Howe, functioned structurally opposite to the Howe truss, Howe having put the verticals in tension and the diagonals in compression. Modern engineers consider the Pratt design to be the first scientifically designed truss (Condit 1960:109). Pratt had recognized and applied a basic principle of structural engineering to truss design: reducing the length of the member in compression, reduces the bending moment, allowing members of smaller cross-section to be used without sacrificing overall strength. The basic design premise of a truss is to provide equal strength with less weight and material than a solid beam and Pratt's innovation applied that principle to the design of the components of the truss itself.

In 1844, Pratt and his father were granted a patent for two truss designs, one with parallel chords, and one with a polygonal top cord. Either design could be built of a combination of wood and iron, or just iron alone. The polygonal version again reflected Pratt's understanding of the application of mathematical principles in calculating the forces involved and the precise strength of material required to counter those forces. Pratt's patent was renewed in 1858. The use of the Pratt truss for the deck of John Roebling's Niagara River Suspension Bridge in 1855 drew worldwide attention to the design and undoubtedly contributed to its increased usage. One of Pratt's best works was the Eastern Railroad's Merrimac River Bridge at Newburyport,

Massachusetts. The Merrimac bridge, completed in 1865, consisted of seven wooden Pratt trusses and a center draw span of iron (ASCE 1876;334-335; Cooper 1889:11; Johnson 1929;179).

In its wooden form, the Pratt truss never attained the popularity of the Howe design, but by 1889 in its iron form it ranked first in usage (Cooper 1889:11). The first all iron Pratt truss bridges were built by J. H. Linville for the Pennsylvania Railroad in 1850. Application of the Pratt truss in its original form reached a high point with the construction of the Erie Railroad Bridge at Portage New York in 1875, and the Cincinnati Southern Railroad Bridge at Cincinnati in 1876, both early landmarks in railroad bridge engineering. Literally thousand of bridges, both highway and railroad have been built following the Pratt design or some variation (Condit 1960:111,112,302).

The Brackett Bridge Company

The Brackett Bridge Company began in Cincinnati, Ohio as the Lomas Blacksmith Shop, established in the mid-1870s by William Lomas. In 1878 the Cincinnati City Directory listed the business as "Wm. Lomas & Co., 21 West Second Street", engaged in the manufacture of tools and vices. The name changed to Lomas Forge and Bridge Company in 1880 as the company redirected its manufacturing efforts to bridges (Miars 1972:21). In 1890, F. J. P. Brackett, the shop superintendent, bought controlling interest of the company and changed the name to the Brackett Bridge Company. The company closed its doors sometime in the mid 1920s (Darnell 1984:48)

According to *A Survey and Photographic Inventory of Metal Truss Bridges in Virginia, 1865-1932*, a study conducted by the VDOT Research Council in 1973, the Brackett Bridge Company built a total of ten truss bridges in Virginia: seven in the Staunton VDOT Construction District, two bridges in the Culpeper District and one in the Lynchburg District (Deibler 1973). Two other Brackett Company bridges, Mansion Truss Bridge (Virginia Bridge # 6904), and Christian's Creek Bridge (Virginia Bridge # 6027), both in Augusta county, are included in the seventeen historic metal truss bridges recorded by Virginia in 1993-1994 of which this report is a part.

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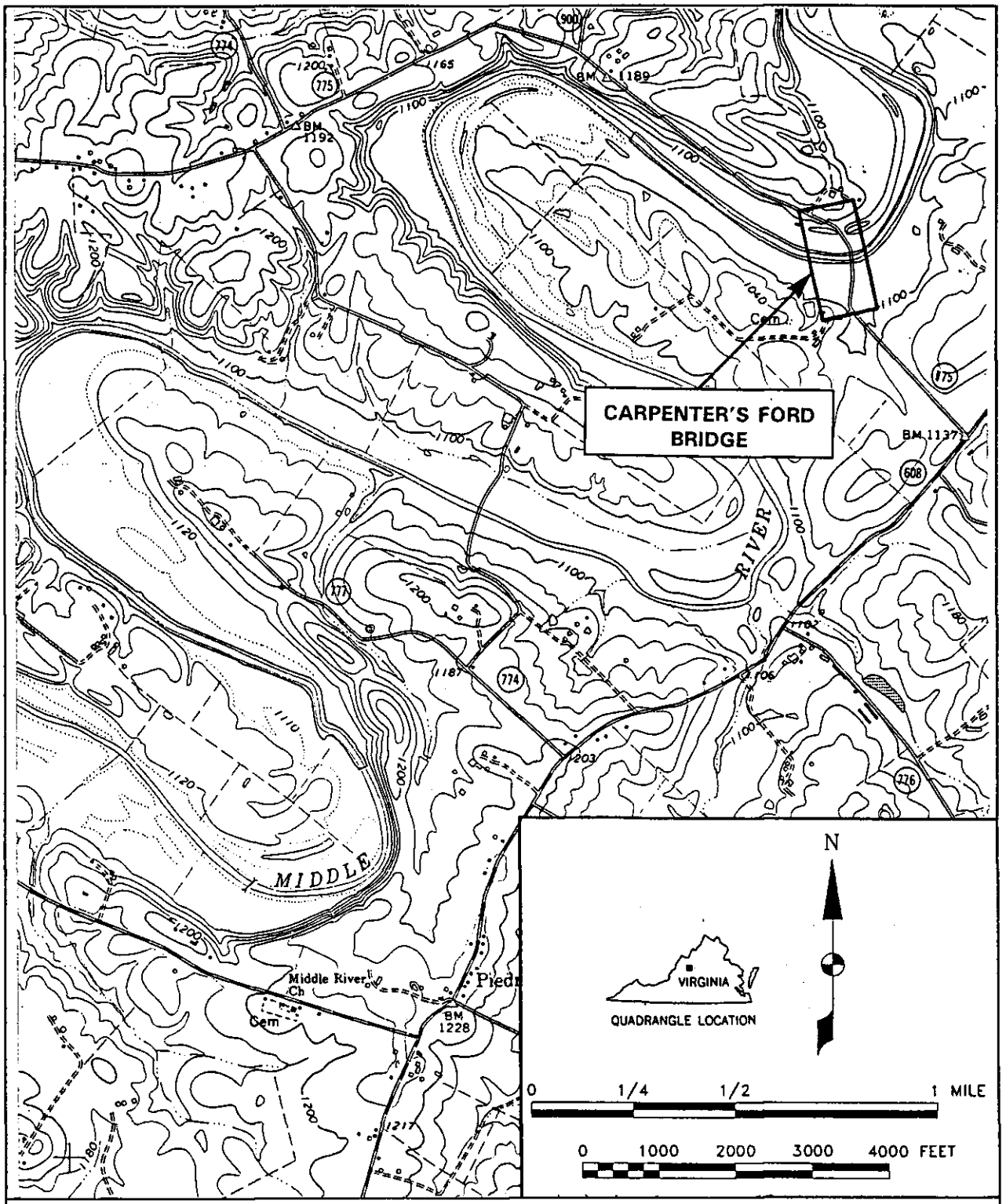

FIGURE 1: Location Map

SOURCE: USGS Fort Defiance, VA, 7.5 Minute Quadrangle, 1964 (Photorevised 1978, Photoinspected 1984)